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**Arrangement for controlling a device, such as  
items of fitness equipment for example**

The invention relates to an arrangement for controlling a device, in particular items of fitness equipment, items of equipment for motion therapy or the like, having at least one actuating device which can be moved about and/or along an axis.

Such arrangements are known and are common on the market in a wide variety of forms and designs. They are known in the field of motion therapy and also in the fitness sector. For example, items of fitness equipment are known in which the load can be simulated but has to be set manually.

In this case, the loads are often changed manually or during operation in corresponding items of training equipment, a factor which is undesirable.

In addition, it is often not possible for the patient or user to permanently influence his sequential training process, in particular during renewed treatments.

In particular, it is very time-consuming and costly to record a completed training program and modify or adapt it to a future training program or a future therapy. To this end, a large number of personnel are necessary, which is likewise undesirable.

The object of the present invention is to provide an arrangement for controlling a device, such as for example items of fitness equipment, items of equipment for motion therapy, with which the above-mentioned disadvantages are removed and which permits a therapy, in particular a motion therapy, and also fitness training and which is simple to adapt individually during operation and also for subsequent therapies.

Furthermore, in particular costs and personnel costs for the modification of therapies, in particular motion therapies, are to be saved.

This object is achieved by virtue of the fact that the at least one actuating device can be driven for simulating an active load.

In the case of the present invention, an arrangement is provided in which an actuating device for simulating an active load can be driven electrically for carrying out a translational and/or rotational movement for a user.

In this case, a drive, in particular an electric motor, is used in order to move the actuating device in a rotational and/or translational manner, as described, for example, in German Utility Model DE 299 17 818.8. Reference is expressly made to the contents of said utility model; it is to be an integral part of the present invention.

Described in this publication is an arrangement for controlling an apparatus, such as, for example, an aircraft, aircraft simulator, robot or the like, in which case a handle can be moved about two axes A and B which are perpendicular to one another. In this case, for the simulation, the handle can be pivoted about the axes via corresponding drives. However, it is also conceivable for the handle to be moved in a linear and/or rotational manner. In the process, the movement of the actuating device or of the handle is effected in a positively controlled manner via the drive.

In particular for motion therapy, this positively controlled movement can be counteracted, for example, by means of a hand in order to carry out a certain therapy process.

In this case, the force, measured at any length of path, is freely selectable, in particular programmable, which force is to be applied in each case to the actuating device.

Furthermore, a sensor, in particular a force sensor, is assigned to the device, in particular the actuating device, this sensor exactly measuring the manually applied force when the actuating device is actuated from outside. A difference or a setpoint/actual-value comparison can be carried out via this force, it being established whether the force is sufficient in order to carry out the therapy process or whether the force is too small or decreases when considered over the therapy period or during the training, so that the active load can be adapted to the changing manually applied force.

In this case, the parameters, such as, for example, pulse and/or blood pressure, can be included in the training or therapy process.

In addition, it is advantageous in the case of the present invention that all the therapies or training sequences can be stored by a data acquisition system and, if need be, can be removed via a chip card, so that they are available again during the renewed training sequence or during the renewed therapy. A therapy or a training process can thus be optimized and influenced in a program-controlled manner.

In this case, for example, the simulation of the active load on the actuating device can be influenced in a program-controlled manner. Likewise, the parameters of speed of the actuating device and lengths of path which can accordingly be covered by the actuating device can be influenced in a program-controlled manner. This electrically driven actuating device or active load is therefore suitable, since no complicated apparatus, items of fitness equipment with weights, or the like are necessary in order to carry out a certain sequence of movement.

These weights may be dispensed with; any desired number of intermediate sizes, different forces for different movements can be set at different lengths of path, which

is not readily possible in the case of items of mechanical fitness equipment. In this case, each training or therapy sequence can be stored completely, which is likewise advantageous.

In addition, totally controlled motion training and/or therapy training and exact process monitoring are effected, which is advantageous.

Further advantages, features and details of the invention follow from the description below of preferred exemplary embodiments and with reference to the drawing, in which:

Figure 1 shows a schematic plan view of an arrangement for controlling a device;

Figure 2 shows a schematic elevation of the arrangement according to figure 1 with a multiplicity of connectable elements.

According to figure 1, an arrangement  $R_1$  according to the invention for controlling a device 1, such as, for example, items of fitness equipment, items of equipment for motion therapy or the like, has an actuating device 2 which can be moved about the axes X, Y and Z and/or along the axes X, Y and Z, as shown in the coordinate system.

The actuating device may be, for example, a joystick, a lever, a pedal or the like. There is no limit to the invention in this respect. The actuating device can be actuated, for example, manually by means of a hand or a foot, an arm or a leg of a human body or with the human body itself.

It permits a certain movement along the axes X, Y, Z in a rotational and/or linear manner, it being of crucial importance in the case of the present invention that the actuating device 2, for simulating an active load, can be driven by means of a drive 3 in a rotational and/or linear manner.

The drive 3 is preferably designed as an electric motor, in which case a gear unit 4 can be interposed or arranged in between actuating device 2 and drive 3.

Furthermore, it is of crucial importance in the case of the present invention that, for continuously and permanently detecting, in particular measuring, a manual force applied to the actuating device 2, a sensor 5, in particular a force sensor, is assigned to the device 1, in particular the actuating device 2.

If a manual force is applied to the actuating device 2, the force sensor 5 determines this manually applied force.

By the active simulation and movement of the actuating device 2 by means of the drive 3, which may be effected in a program-controlled manner, determinable and certain sequences of movement at a certain speed over certain lengths of path or at certain rotational angles being possible, freely selectable sequences of movement can be programmed and carried out.

To this end, for example, the patient can move the actuating device 2 via a "teach-in method", the movement being stored in a personal computer 6, see figure 2, and then the device 1, for simulating an active load, repeating this input movement, in particular this therapeutic movement of the actuating device 2 to be executed, as often as desired via the drive 3.

The patient follows up this entire movement by means of his arm for example.

In this case, the user, with this movement, can counteract a manually applied force F, which is merely indicated symbolically in figures 1 and 2. For example, he can

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actuate the actuating device 2 with a determinable force, the arrangement  $R_1$ , in particular the device 1, counteracting with this force via the drive 3.

The magnitude of the applied force can be determined exactly via the force sensor 5, it being possible to control and influence the movement by a comparison between setpoint and actual value after the manual force has been applied to the actuating device 2.

If the manual force applied to the actuating device 2 is too small in order to move the device 1, in particular the actuating device 2, in the programmed sequence of movement, the active load can be reduced in a program-controlled manner.

In this case, at the arrangement  $R_2$ , as shown in particular in figure 2, a pulse sensor 7 or blood-pressure sensor 8, which is connected to the user, in particular the patient, may be connected to the personal computer 6 or to the device 1 in order to influence the control of the active load or the simulation of the active load and in particular the active actuation of the actuating device 2 via the drive 3.

If the pulse and the blood pressure increase to an undesirably high extent, the active load is automatically reduced or increased, in accordance with the desired and programmable sequence.

Furthermore, it is advantageous in the case of the present invention that the individual training sequences or therapy sequences can be stored, for example, in a data acquisition system 9, in particular a data carrier, and, if need be, via an externally removable chip card 10.

A follow-up therapy or the follow-up training can thus be influenced with the aid of the stored data by virtue of the fact that the active loads for the follow-up training can be increased, reduced or changed or the corresponding movements of the actuating

devices 2 can be adapted or modified. This is likewise to be within the scope of the present invention.

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List of item numbers

- |                |                         |
|----------------|-------------------------|
| 1              | Device                  |
| 2              | Actuating device        |
| 3              | Drive                   |
| 4              | Gear unit               |
| 5              | Sensor                  |
| 6              | Personal computer       |
| 7              | Pulse sensor            |
| 8              | Blood-pressure sensor   |
| 9              | Data acquisition system |
| 10             | Chip card               |
|                |                         |
| R <sub>1</sub> | Arrangement             |
| R <sub>2</sub> | Arrangement             |
|                |                         |
| F              | Force                   |
| S              | Path                    |